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Voltage Inverter with Cascade Stage

The circuit diagram shows a switched-capacitor voltage inverter with +5-V input and –3-V output, along with a supplementary cascade stage to generate a +17-V auxiliary voltage. The capacitor connected to the CP– and CP+ terminals assists in inverting the input voltage. During the first clock phase it is charged to the input voltage, while during the second clock phase its positive terminal is connected to ground while its other terminal is connected to the output. This generates a negative voltage at the output, with an amplitude equal to the input voltage. Using the duty cycle, the IC described here generates a regulated output voltage of –3 V with a current capacity of 120 mA.

The clocked operation makes it possible to connect an additional diode cascade stage for voltage multiplication. This consists of a series of diodes (for instance, type SS24 SMD Schottky diodes) with alternating pump and storage capacitors. The pump capacitors are connected to CP+ and charge when CP+ is at ground potential. When CP+ goes to a high-potential level, the potentials on the upper plates of the pump capacitors are pushed up. Each pump capacitor then discharges into the following storage capacitor (connected to ground) via the intermediate diode. The voltage increases with each pump stage, resulting in a net voltage of around +17 V after three voltage boosts, with a maximum load capacity of 3 mA.

The type ADP3605 IC is available from Analog Devices (www.analog.com/productSelection/pdf/ADP3605_a.pdf) and is housed in an SO8 SMD package. A High level (> +2.4 V) can be applied to the Shutdown input (SD) to disable the converter.

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